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An Empirical Analysis

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Some new empirical evidence on the determination of long-term interest rates in the United States is presented. The empirical results generally support the view that fiscal deficits raise real long-term interest rates. The paper also discusses both theoretical considerations and other empirical evidence that suggest that neither the response of private saving nor international capital mobility has prevented budget deficits from raising interest rates.

DURING THE 1980s real interest rates in the United States have been high by historical standards. Many economists have attributed the high level of interest rates to the large current and projected budget deficits of the federal government. But some empirical studies have failed to find that fiscal deficits have a significant positive effect on interest rates in the United States (see, for example, U.S. Treasury (1984), Evans (1985), and Spiro (1987)). This paper presents some new evidence on the determination of long-term interest rates in the United States in support of the view that large anticipated fiscal deficits raise long-term interest rates.[1]

The relationship between long-term interest rates and fiscal deficits is

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[1] Tanzi (1987) briefly reports on some of the evidence that is described more fully in the present study. Bovenberg (1987b) contains some empirical results on short-term interest rates and offers various reasons why several empirical studies have failed to find that budget deficits in the United States have significant positive effects on domestic interest rates.

of particular interest for at least three reasons. First, economists generally theorize that long-term rather than short-term interest rates transmit most of the crowding-out effects of fiscal deficits to the real side of the economy because interest-sensitive components of private spending, such as business fixed investment and home construction, are most sensitive to variations in long-term interest rates. Second, fiscal deficits may have larger effects on long-term interest rates than on short-term rates because the foreign supply of short-term credit is usually more elastic than the foreign supply of long-term credit. This situation arises because long-term foreign investment in the United States is generally riskier than short-term foreign investment, considering the high costs of foreign exchange cover for long-term investments.[2] Third, fundamental fiscal effects may play the most important role in the determination of long-term interest rates. In contrast, monetary and transitory factors may dominate in the explanation of short-term rates. Consequently, short-term rates may be more volatile and more difficult to explain, particularly when the monetary policy regime is changing. In fact, Kaufman and Lombra (1986) and Peek and Wilcox (1987) suggest that changes in the monetary policy regime have substantially affected the determination of short-term interest rates in the United States.

I. Empirical Framework and Relation to Other Studies

To accommodate the analysis of long-term interest rates, this study modifies the specific framework that was used by Tanzi (1985) to explain short-term rates. The only independent nonfiscal variable is the expected rate of inflation for several years in the future. In contrast to Tanzi (1985), the analysis excludes a variable measuring economic activity because cyclical fluctuations are much less likely to affect yields on long-term bonds than those on shorter-term financial instruments (see, for example, Tanzi (1985, p. 571)).

As regards the explanatory fiscal variable, anticipated future deficits rather than the deficit in any given year affect long-term interest rates in forward-looking financial markets because current long-term interest rates adjust whenever financial markets anticipate that future changes in asset supply and demand will affect short-term interest rates.[3]

[2] Hoelscher (1986) provides additional reasons why the supply of long-term credit is least elastic.

[3] Feldstein (1986b) discusses extensively why regressing long-term interest rates on current deficits leads to misleading results. Feldstein (1986a) criticizes the procedure adopted in Plosser (1982). The latter study relates long-term interest rates to "surprises" in fiscal deficits, which are calculated as the residuals

Muller and Price (1984) show how the failure to include forward-looking expectations of budget deficits in equations explaining long-term interest rates can give rise to misleading results. They treat the procedure that adjusts the explanatory fiscal variables for both the business cycle and expectations as an empirical matter. They find that they need to take a centered moving average of the fiscal deficit variable over seven to nine years to find a significant positive effect on long-term interest rates. When using only backward-looking averages of the deficit variable, they find a significant negative effect. They fail to find any significant effect when adopting contemporaneous values for the deficit variable. In contrast to the equations using forward-looking variables, the equations adopting either backward-looking or concurrent variables suffer from serious autocorrelation, which suggests that a forward-looking deficit variable belongs in an equation explaining long-term interest rates.[4]

II. Statistical Results

The regression results for 1961–85 are contained in Table 1. Equations (1)–(4) adopt as the dependent variable the rate of interest on ten-year U.S. Treasury bonds. In these equations, the expected rate of inflation from 1979 onward is derived from a survey conducted by A.C. Becker, Aribas, Inc. on expected inflation measured ten years ahead. For years prior to 1979, a four-quarter moving average of the University of Michigan's survey of price expectations one year ahead is used.

The variable for the anticipated fiscal deficit is the average ratio of the cyclically adjusted federal budget deficit to trend gross national product (GNP) for five years ahead including the current year. This five-year forecast horizon corresponds to institutional circumstances in the United States, where the authorities prepare forecasts for the federal budget on a five-year basis. The measures for trend GNP and for the cyclically adjusted federal budget deficit were prepared by de Leeuw and Holloway, of the U.S. Department of Commerce, and are based on a midcycle

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from vector autoregression predictions, rather than to the sequence of expected future deficits. Blanchard (1985) and Frenkel and Razin (1987) also emphasize the role of anticipated future deficits in the determination of long-term interest rates.

[4] Both Evans (1985) and U.S. Treasury (1984) use concurrent fiscal deficit variables rather than anticipated future deficits in equations explaining long-term interest rates. Their estimated coefficients associated with fiscal deficits are therefore likely to be biased downward.

expansion trend of GNP. Holloway (1986) explains how these two series were derived and updated.

Although five-year forecasts of the deficit and of GNP have been prepared in recent years, they do not exist for the entire sample period. Following Feldstein (1986a, 1986b), this paper generally assumes, therefore, that the ratio of the actual deficit to trend GNP is the best estimate for the value of this ratio previously anticipated by participants in financial markets. For the years 1985 and beyond, the ratio of projected deficit to trend GNP is measured by the February 1985 forecasts of the U.S. Congressional Budget Office (CBO).

Both equation (1), which uses semiannual data, and equation (2), which uses annual data, indicate that the deficit variable raises the interest rate and is highly significant. Equations (3) and (4) make more extensive use of the deficit projections of the CBO. Equation (3), which uses the CBO projections from 1976 when they were first prepared, yields disappointing results. Equation (4), in contrast, uses these projections only from 1982 onward because those prepared by the CBO before 1982, and in 1980 and 1981 in particular, were generally regarded by financial markets as unduly low. Comparing equation (4) with equation (2), it appears that the coefficient for the deficit variable, although somewhat smaller, is more significant.

The size of the coefficient for the anticipated deficit in equation (4) implies that, if feedback effects on expected inflation are ignored, a sustained reduction in the fiscal deficit of about 1 percent of GNP would reduce long-term interest rates by almost 115 basis points. The equation can also be used to interpret the factors behind the increase in the ten-year bond yield, from 7.7 percent in 1977 to 11.8 percent in 1983. Since the anticipated deficit to GNP ratio rose by 2.5 percentage points during this period, rising fiscal deficits accounted for about two thirds of the observed increase in long-term interest rates. These results are broadly consistent with those reported in Feldstein (1986b).[5]

Equations (5), (6), and (7) adopt as the dependent variable the rate of interest on U.S. Treasury bonds of three years to maturity and use annual data. The Livingston index based on expected inflation measured one year ahead is used in these equations. This index is commonly used in empirical work relating to expected inflation (see Carlson (1977) and Tanzi (1985)). The fiscal deficit variable in equation (5) is the average ratio of the actual cyclically adjusted federal budget deficits to trend

[5] Feldstein (1986b) estimates that the rise in projected deficits in the early 1980s was responsible for about two thirds of the observed increase in interest rates during 1977–83. Muller and Price (1984) find that fiscal policy accounts for almost the entire increase in long-term interest rates during this period.

Table 1. *Regressions Explaining Yield on Long-Term U.S. Treasury Bonds*

Equation	Dependent Variable	Constant	P	DE	ρ	DW	$\bar{R}^2$	$r(DE, P)$
(1)	$R(10)$	1.25 (1.56)	0.44 (3.17)**	1.74 (6.09)**	0.59	1.89	0.91	0.58
(2)	$R(10)$	1.17 (1.37)	0.51 (5.33)**	1.59 (3.37)**	0.32	1.94	0.87	0.60
(3)	$R(10)$	9.6 (2.66)*	0.24 (1.35)	0.09 (0.62)	0.93	2.24	0.85	0.07
(4)	$R(10)$	1.45 (2.56)*	0.64 (5.27)**	1.13 (6.36)**		1.49	0.86	0.55
(5)	$R(3)$	1.99 (2.51)*	0.64 (4.55)**	1.19 (3.90)**	0.57	2.08	0.86	0.52
(6)	$R(3)$	1.85 (1.94)	0.97 (6.48)**	0.55 (3.22)**	0.54	1.91	0.87	0.13
(7)	$R(3)$	1.91 (2.76)*	0.76 (6.25)**	0.86 (4.14)**	0.37	1.99	0.88	0.48

Note: Annual data were used in all equations except equations (1) and (5), in which semiannual data were used. All equations except equation (4) were adjusted for serial correlation by a first-order Cochrane-Orcutt correction procedure; t-statistics appear in parentheses; two asterisks indicate significance at the 1 percent level, and one asterisk indicates significance at the 5 percent level; $R(10)$ is the yield on ten-year and $R(3)$ the yield on three-year U.S. Treasury bonds; P is the measure for inflation expectations (see text); DE represents anticipated fiscal deficits as a percentage of trend GNP (see text); ρ denotes the coefficient of first-order autocorrelation; DW is the Durbin-Watson test statistic; $\bar{R}^2$ is the adjusted coefficient of determination; and $r(DE, P)$ represents the correlation coefficient between P and DE.

GNP for three years ahead, which is constructed in a way analogous to that for the fiscal deficit variable in equations (1) and (2). Equations (6) and (7) correspond to equations (3) and (4), respectively, with regard to the construction of the deficit variable; equation (6) adopts the CBO forecasts available since 1976, and equation (7) uses only those prepared since 1982. The effects of anticipated deficits on three-year interest rates as estimated by equations (5) and (7) are highly significant, although they are somewhat smaller than the effects in the corresponding equations for ten-year interest rates.[6]

The coefficient for the deficit variable in equation (6) is highly significant, in contrast to the coefficient in the corresponding equation for interest rates on ten-year securities (equation (3)). This result may be partly because the pre-1982 CBO forecasts for one, two, and three years ahead were better approximations for expectations in financial markets than those for four and five years ahead.

The results on long-term interest rates are stronger than those reported in Hoelscher (1986), who examines the determination of long-term interest rates for 1953–84 and includes the short-term yields as an explanatory variable. His results, therefore, indicate only that fiscal deficits increase the slope of the yield curve by raising long-term yields relative to shorter-term yields. In contrast, the results reported here indicate that fiscal deficits raise long-term interest rates in an absolute rather than in a relative sense.

III. Conclusions

This paper has addressed the ongoing debate about the relationship between fiscal deficits and interest rates in the United States. It presents some evidence in support of the view that anticipated fiscal deficits raise long-term interest rates. In particular, the specific parameter estimates suggest that the increase in anticipated deficits in the early 1980s accounted for most of the rise in the long-term interest rates during 1977–83.

Other empirical evidence, together with theoretical considerations, generally confirms the view that budget deficits do raise interest rates. Some economists have denied the existence of a relationship between fiscal deficits and interest rates on theoretical grounds. Barro (1974) and Evans (1985), for example, used the Ricardian equivalence hypothesis to

[6] These results are consistent with the smaller effects of deficits on one-year yields found in Bovenberg (1987b); fiscal deficits appear to have larger effects on longer-term than on shorter-term interest rates.

claim that budget deficits arising from temporary tax cuts would not affect either national saving or interest rates.[7] But Poterba and Summers (1987) argue quite convincingly that the recent U.S. experience casts significant doubt on the assumptions underlying the Ricardian equivalence view. Their analysis reveals that rising fiscal deficits in the United States played a crucial role in reducing national saving because factors other than the fiscal deficit—such as cyclical conditions, inflation, or the behavior of the stock market—failed to explain that reduction.

Others have maintained that fiscal deficits do not affect interest rates, even if they reduce national saving, because the deficits can be financed by capital inflows from abroad. Whereas large capital inflows moderated the effect of the recent large budget deficits in the United States on domestic interest rates, they did not completely offset this effect, for at least three reasons. First, U.S. assets and foreign assets are imperfect substitutes. Therefore, to attract foreign capital, interest rates in the United States had to rise relative to those abroad. Second, the U.S. economy is so large that its fiscal deficit affects interest rates in world capital markets. For this reason alone, the United States faced a supply of funds schedule that was upward sloping. Third, even in integrated world financial markets, national saving-investment imbalances generally put pressure on domestic resources and, therefore, on domestic real interest rates, because trade flows are imperfectly elastic with respect to real exchange rates, causing the failure of purchasing-power-parity conditions (see, for example, Frankel (1985) and Bovenberg (1987a)).

In conclusion, most evidence, including that presented in this paper, suggests that neither the response of private saving to budget deficits nor international capital mobility seems to prevent fiscal deficits from raising long-term interest rates.

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[7] The literature on the Ricardian equivalence hypothesis is extensive. For a survey of this literature and a discussion of the implications of relaxing the restrictive assumptions underlying the hypothesis, see Leiderman and Blejer (1988).

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